INSTRUCTION MANUAL FOR

Oscilloscope Plug-in Unit

OS2005AX

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CONTENTS

Twin timebases and exceptional triggering characteristics are the principle features of the OS2005AX Delay Sweep Timebase. When used with any of the OS2000, OS2100 or OS2200 series of main frames, NORMAL SWEEP, VARIABLE DELAY SWEEP or GATED DELAY SWEEP modes of operation, may be selected. Comprehensive single shot facilities for photographic recording are provided in ALL modes of operation. A dc trigger caters for accurate triggering at low frequencies.

Timebase A, with nineteen calibrated sweep speeds from 200mS/cm to 0.2μS/cm and continuously variable 3:1 fine control, provides the sweep for NORMAL and A INTENSIFIED BY B modes of operation. It is also used together with a 10 turn calibrated potentiometer to provide the delay (0.2μS to 2S) for the 'B' timebase.

Timebase B, with eighteen calibrated sweep speeds from 100mS/cm to 0.2μS/cm, provides the sweep in the delay mode (B DELAYED BY A). Either of the delay modes or their respective 'bright-up' traces (A INTENSIFIED BY B), may be selected by a four position lever switch on the front panel.

For the majority of input signals, the variable delay sweep mode of operation with a jitter ratio performance of better than 10,000:1, is more than adequate. However, for a JITTER FREE display of time modulated waveforms, the gated delay sweep facility is invaluable; provision has been made for independant selection of trigger source, slope and level in this mode.

The gate waveforms from the timebases "A" and "B" are available from sockets on the front panel. A x5 magnifier expands the sweep length to effectively five screen diameters and provides a maximum sweep speed of 40nS/cm.

HORIZONTAL DEFLECTION

TIMEBASE A

0.2μS/cm to 200mS/cm in 19 calibrated ranges (1-2-5 sequence).
Measuring accuracy 5%.
Fine velocity control reduces timebase speeds by greater than 3:1 and down to 1S/cm approximately.

TIMEBASE B

0.2μS/cm to 100mS/cm in 18 calibrated ranges (1-2-5 sequence).
Measuring accuracy 5%.

X5 MAGNIFIER

Operates on all displayed sweep speeds. Increases the fastest sweep speed to 40nS/cm.

DELAY TIME

Continuously variable from 0.2μS to 2S. A ten turn potentiometer with counter dial is calibrated in cm deflection of Timebase A.
Accuracy ±5%. Minimum delay 0.2cm from start of Timebase A.

JITTER

In the delay sweep mode, less than 1 part in 10,000 of the maximum delay on range selected.

DELAY MODES

Variable Delay Sweep (SWEEP): the delayed sweep starts automatically at the completion of the delay period. Gated Delay Sweep (GATE): the delayed sweep is TRIGGERED by the next selected transient following the delay period thus providing a 'jitter free' display.

OPERATING MODES

A only (Normal operation – equivalent to OS3003X.
A intensified by B (SWEEP mode)
A intensified by B (GATE mode)
B delayed by A (SWEEP mode)
B delayed by A (GATE mode)
Selection is by means of a lever switch on the front panel.
Differential brilliance adjustment for the A INTENSIFIED BY B modes is provided by a front panel pre-set adjustment.

EXTERNAL X

Selected on Timebase A range switch. Sensitivity 1V/cm ±5% (0.2V/cm ±5% using X5 magnifier), DC to 500kHz (-3dB) in OS2000 DC to 1MHz (-3dB) in OS2100 and OS2200. Input impedance 1MΩ ±10% shunted by 20pF approximately.

TRIGGER SYSTEM

TRIGGER SOURCE (Independent A and B)

INTernal (selection from Y input plug-in), EXTernal, LINE. Source switch A also selects FREE RUN. One External trigger socket feeds A and B trigger circuits.

TRIGGER POLARITY (Independent A and B)

Positive or negative.

TRIGGER LEVEL (Independent A and B)

The level control for timebase A can be switched to AUTO for automatic triggering over the frequency range 40Hz to 25MHz.

TRIGGER SENSITIVITY

Internal: 2mm vertical deflection (typically 3mm on Gated Delay Sweep).
External: typically 200mV pk to pk.

TRIGGER COUPLING (Independent A and B)

AC., HF. REJ., or DC selected by switch. (AC coupling is automatically selected in AUTO mode).

SINGLE SHOT

Facilities are provided for the photographic recording of displayed phenomena in ALL FIVE OPERATING MODES. A spring return lever switch ARMS the timebase which will execute a single sweep on the next trigger pulse received. A neon lamp indicates the ARMED state fo the trigger.

SIGNAL OUTPUTS

Gate pulse from A and B: approximately +10V from 10kΩ source.

DIMENSIONS AND WEIGHT

4⅜" (11cm) wide
6¼" (15.8cm) high
10⅝" (23.8cm) long
3⅝ lbs (1.7kg)

This unit can be used on the OS2000, OS2100 or OS2200 series of main frames. However its full potential is only realised in the OS2100 and OS2200 with their brighter display of fast sweeps at low repetition rates.

3.1 CONTROLS

A and B TIME/CM

This is a triple control. The main knob selects A and B timebase velocities from 0.2μS/cm to 200mS/cm and also external X, having 20 positions in all. The knob skirt is separate from the knob, but the two are locked together when the white line on the knob is coincident with the hair lines on the skirt. The skirt indicates the sweep speed of Timebase A and is set by the knob when it is locked to the skirt. (In this condition, the plug-in operates conventionally on Timebase A). The knob can be unlocked from the skirt by pulling and turning clockwise. Timebase B then also operates and the white line on the knob indicates its sweep speed. The mode in which the two timebases then operate is determined by the display lever switch.

Rotation of concentric red capped knob varies the Timebase A fine velocity, decreasing velocity as it is turned anticlockwise from its calibrated position. When the knob is pulled out, it will give X5 expansion to the horizontal deflection, (A Sweep, B Sweep or External X).

'A' TRIG. SOURCE AND SLOPE

This trigger selector switch selects the trigger source for the 'A' trigger circuits. It has two positions for each source. These are EXT±, INT± and LINE±. The most anticlockwise position (FREE RUN) makes Timebase A run without trigger and is useful for trace location or when using the timebase as a waveform generator.

B TRIG. SOURCE AND SLOPE

This is concentric with the A Trigger source switch and can be switched to all the positions of the A trigger switch except FREE RUN.

'A' LEVEL

This is on the right hand side of the A and B Trig. source switches. The point at which the trigger circuits operate can be adjusted bytthis control over the 6cm of screen deflection. The AUTO level mode is selected in the extreme anticlockwise position of this control. The trigger level is then set to the mean level of the signal, ensuring that the time base will trigger. The system will operate correctly on signals having a frequency greater than 40Hz and a mark space ratio less than 1:10;

'B' LEVEL

The 'B' trigger level can be adjusted independantly of the 'A' trigger level. The control is on the left hand side of the trigger source switch.

AC, DC, HF REJ.

These switches select the type of coupling from the trigger sources to the trigger amplifiers. AC coupling is used normally. DC coupling is useful at very low frequencies and on waveforms where the mark space ratio varies. The HF REJ position is also AC coupled but with a low pass filter inserted which reduces the trigger sensitivity at high frequencies.

DISPLAY SWITCH

This is a four position lever switch. It operates electrically only when the A and B time bases are set to different ranges and this is indicated by its associated neon light. The first (left) position is A brightened by B (sweep), where the B timebase starts at the end of the delay period set and the trace is brightened for the running time of the B time base. The A time base is still used to deflect the CRT beam and is visible at reduced brightness.

The second position is A brightened by B (gate), when the B time base starts on the first B trigger pulse after the delay period. The display is as before, but the bright-up portion of the trace only appears if the B timebase is triggered.

The third position effectively expands the bright-up portion on the A brightened by B (sweep) display, to fill the screen. The fourth position does this for A brightened by B (gate). The B time base is used to deflect the CRT beam, its starting time relative to the A time base start being that set on the A brightened by B mode.

CONTRAST

This adjusts the contrast in the A INTENSIFIED BY B modes.

3.2 DELAY FUNCTIONS

Assume a complex waveform is being displayed with the TIME/CM switch in the locked position, (timebase A only displayed). The 'A' trigger source, slope polarity and level have been chosen to obtain a stable display as shown, for example, in Fig. 6 (Trace A).

It is desired to observe a small part of this waveform.

STEP 1

Set the DISPLAY switch to the left hand position (A intensified by B (sweep)). Pull the TIME/CM switch and turn clockwise. The A ONLY neon will extinguish and the DISPLAY switch neon will light. A portion of the trace will remain at normal brilliance, indicating the delay and duration of timebase B, the rest dimming to a level determined by the contrast control.

STEP 2

Vary the length of the intensified portion (by turning the TIME/CM switch) so that the whole of the portion to be examined can be covered. Move the intensified portion along Timebase A (using the DELAY control) to cover the required part. The 10 turns of this control cover 10cm of the sweep of timebase A, giving fine resolution and a calibrated scale.

STEP 3

Move DISPLAY switch to B DELAYED BY A (SWEEP) in order to display timebase B only. The intensified portion will now expand to over 10cm as shown in TRACE B (Fig. 8).

STEP 4

When using a fast sweep to examine a portion of a waveform after a long delay any time jitter present on the waveform or on the delay period will be apparent on the trace. The gated function can be used to avoid this. In this mode, the timebase B is not initiated immediately at the end of the delay time (as in sweep mode but at the first B trigger point following the end of the delay period.

To obtain this, select A INTENS BY B (GATED) with the display switch. Choose the correct 'B' trigger slope polarity and operate B LEVEL to obtain the intensified portion where required, as shown in TRACE C (Fig. 6).

STEP 5

To expand the intensified portion while maintaining gated operation, select B DELAYED BY A (GATED). The display jitter should now be eliminated. In this mode, care must be taken in operating the DELAY potentiometer because the B timebase start will jump from edge to edge as the delay time is altered. Therefore, it is recommended that when this control is operated in the gated mode, it is with A INTENS BY B displayed, so that the start position of the B timebase is known.

NOTE Jitter of the delay period is specified as a proportion of the maximum delay available on the selected timebase A range, i.e. with timebase A on 1mS/cm calibrated, the maximum delay, available is 10mS. If this jitter is 1/20,000 of the available delay, the jitter will be .5μS. Thus when observing a very small part of the 'A' sweep the A sweep speed should be made as fast as possible to reduce jitter and at the same time this will give maximum brightness on B DELAYED BY A.

3.3 EXTERNAL X AND EXTERNAL TRIGGER

The EXT.X and EXT TRIG sockets are coupled by a capacitor, the EXT X socket then being directly coupled to an amplifier. If it is required to directly couple an external trigger signal, then it should be applied to the EXT X socket. Conversely if it is required to AC couple an external X signal, it should be applied to the EXT TRIG socket. The bandwidth on external X is approximately 500kHz (-3dB) when used in the OS2000, and 1MHz in the OS2100.

3.4 OUTPUT SIGNALS

Output waveforms are available from two 2mm sockets. These are:– GATE 'A' and 'B', and are positive going pulses of approx. 10V from ground, present for the period of the A and B timebases sweeps respectively, from a source of approx. 10KΩ.

4.1 A TIMEBASE AND TRIGGER

4.1.1 TRIGGER SELECTION, COUPLING AND AMPLIFICATION

All trigger signals, INTernal EXTernal, LINE, are taken to S3. The internal trigger signals are taken from emitter followers, TR201 and TR202, which also feed the internal trigger to the B time base trigger switch. From S3, the trigger signals are taken to S5, the coupling switch, and then to the bases of emitter followers, TR203 and TR212. From the emitters of these transistors the signal is taken via R271 and R272 to TR213 and TR214, a long tail pair amplifier. The trigger LEVEL control alters the dc bias across R271 and R272. The collector of TR214 is taken to the shunt feedback stage, TR216. The signal at the collector of TR216 is applied to the 'A' Scmitt trigger circuit.

4.1.2 TRIGGER CIRCUIT

The Schmitt trigger consists of TR201 and TR205. Signals are applied via emitter follower, TR217. The AUTO mode is achieved by ac coupling the trigger signal to TR217, and allowing feedback to this capacitor via R220. The LEVEL potentiometer (R25) is disconnected in this mode.

4.1.3 TIMEBASE BISTABLE AND RAMP GENERATOR

Pulses from the collector of TR205 are applied to the bistable, TR206, TR207 and TR211. The bistable is held with TR207 on, TR211 on and TR206 off, by having D202 and D203 forward biased on the base of TR206, and D205 forward biased on the base of TR207 The base of TR207 is thus at a higher potential (by +.5V) than the base of TR206. A positive going pulse from TR205 will turn on TR206 and turn off TR207 and TR211. TR211 controls the diode switch (D207, D208 and D209) which holds the timing capacitor at zero potential. When TR211 turns off, the capacitor charges positively via R2 to R9. The potential across these resistors is held constant by the bootstrap system, incorporating IC201 amplifier and dual FET, TR218, as an accurate X1 amplifier of very high input impedance. This amplifier has low drift and the zeners, D211 and D212, are also low temperature coefficient types. This ramp is taken to the Function Board from pins, 30 and 31.

4.1.4 HOLD OFF CIRCUIT

The ramp is also applied through D210 to another capacitor (the next smallest in the series of timing capacitors), and via TR209, TR208 and R234, to the base of TR207. When the base voltage of TR207 is more positive than that of TR206, the bistable will reset; turning on TR211 and discharging the timing capacitor. However the hold-off capacitor, charged via D210, discharges slowly via R236; hence the base voltage of TR207 slowly approaches its quiescent state. The bistable cannot be triggered again until this voltage is exceeded by the peak voltage of trigger pulses on the base of TR206. Hence a short period is obtained during which the timing capacitor can discharge completely. The pulse at the collector of TR211 is taken via TR210 to the Function Board and is used to 'bright-up' the cathode ray tube.

4.2 FUNCTION CIRCUITS

4.2.1 COMPARATOR

The 'A' ramp is applied, via pin 31 to one input of the differential input integrated amplifier (IC101). The other input is connected to the wiper of a ten-turn potentiometer (R13). When the ramp voltage exceeds the comparator voltage, current flows from the amplifier into the base of TR113, turning on this transistor. Its collector current flows into the tunnel diode, D124, if TR112 is off (This is determined by the state of the bistable TR116 and TR117). When the tunnel diode switches on, TR111 is turned on; turning off TR110 and allowing the timebase B to be triggered (TR109 off) or starting timebase B immediately (TR109 on).

4.2.2 BISTABLE, TR116 and TR117

This bistable is switched by the 'A' gate pulse via TR108. When the 'A' gate pulse poes positive (timebase A running), this positive edge turns on TR116 via C106 and TR117 turns off. TR112 is also turned off. The bistable is reset at the end of the timebase A or B sweep by whichever event happens first. The 'A' reset is via C106 and the B reset via pin 44 and D135. When this bistable is reset, TR112 is turned on, resetting the tunnel diode, turning off TR111, TR110 on and inhibiting or resetting timebase B.

4.2.3 SINGLE SHOT OPERATION

When the mode switch (S7) is moved from normal to single shot operation TR115 is connected to the bistable consisting of TR116 and TR117. The collector of TR115 goes to timebase A. When TR115 is turned on, trigger pulses are prevented from reaching the timebase A bistable. Operation is as follows:–

At the end of an 'A' sweep, bistable, TR116/117, is reset so that TR116 is off, turning on TR115 and preventing a further sweep. The bistable can be set by moving S7 to the ARM position, thus removing the trigger inhibit and allowing timebase A to trigger on the next trigger pulse. Neon N106 indicates the state of the bistable when in the single shot mode, turning on when the ARM button is pressed and off at the end of the 'A' ramp (or 'B' ramp if this is running).

4.2.4 DISPLAY SWITCH

When the TIME/CM control is pulled out and turned, N1, the A ONLY neon (controlled by S8) is extinguished, and voltage is applied to the display switch circuits, Neon, N2, is struck through R120 and TR102 is turned off, turning on TR103. This connects the wiper of S11 to -12V, enabling diode gates, D109/110, D111/112, D113/114/115 and D116/117/118 to be operated. The operation of the pull switch, S8, also removes voltage from R158 and D136, enabling the comparator to operate. In the left hand position D109/110 are connected to -12V, turning on the A ramp gate, D103/104,

and turning on TR109. Under these conditions the A ramp will be applied to the CRT and the B timebase will start at the end of the delay period.

The next position turns off TR109, but applies voltage to the B time base Schmitt trigger circuit, so that the B time base is trggerable at the end of the delay period.

The two right hand positions operate the B time base gate so that the B timebase is displayed, starting either after the delay period, or on the first B trigger pulse after the delay period.

4.2.5 BRIGHT UP CIRCUIT

With the TIME/CM SWITCH in the locked position (A only), TR106 is turned on and saturated, connecting the A timebase gate pulse (pin 22) to pin 50 which is connected to the bright-up amplifier in the main frame.

When the TIME/CM switch is pulled and locked and the DISPLAY switch is in the A intensified by B position, the A timebase gate pulse is connected to the base of TR107 via D120. When the gate pulse goes +ve (A timebase running), TR107 is turned on, switching the current out of R126/R22, from D123 to pin 49. This current is used in the main frame to operate the bright-up circuit and the trace brightness can be varied by adjusting R22. TR105 is saturated by current through R121, connecting the B timebase gate pulse to pin 50. Thus the A timebase trace can be dimmed and the running time of the B timebase made visible at normal brightness. When the B DELAYED BY A positions are selected; diode D120 is turned off, thus preventing TR107 from switching on.

4.3 B TIMEBASE AND TRIGGER

4.3.1 TRIGGER SELECTION, COUPLING AND AMPLIFICATION

Trigger signals (INTernal, EXTernal, LINE) are taken to S4, the B trigger source switch. The selected trigger signal is taken via S6, the trigger coupling switch (AC, HF REJ., DC); to the trigger amplifier, TR305/308. The B LEVEL control alters the DC bias across R334 and R338. The trigger signal at the collector of TR307 is taken to the shunt feedback stage, TR309. The signal at the collector of TR309 is applied to the Schmitt trigger circuit.

4.3.2 'B' SCHMITT TRIGGER CIRCUIT

The Schmitt trigger circuit consists of TR311 and TR312. TR310 is an emitter follower. There is no AUTO trigger level circuit on the B time base Schmitt. To prevent interference from the Schmitt trigger pulses during "delayed sweep" operation, the negative supply to R355 is removed by diode gate D111 and D116, on the Function Board.

4.3.3 TIMEBASE BISTABLE AND RAMP GENERATOR

When a trigger signal goes more positive than about +6V, TR311 switches on and TR312 switches off. Current previously flowing in R347 now flows to ground in C309 and D305. When the comparator operates at the end of the delay period, current flowing from pin 42 into D305 (via R356/D306), is reduced to zero (gated mode) or reversed (sweep mode). Therefore, in the first case trigger pulses via C309 will cause the base of TR313 to go positive, in the second case current flowing from pin 42 via D310 will have the same effect.

When the base of TR313 goes positive; the bistable, TR313/TR314/TR315, is set. TR315 is timebase B gate transistor and holds the 'B' timing capacitors at ground potential when turned on. When the bistable is set, TR315 turns off, its collector rising to +10V, enabling the 'B' ramp generator to run. The ramp generator is a bootstrap circuit consisting of an FET TR318, TR320 and TR321, with TR319 as a pre-set current source to take up variations in the FET bias voltage. The ramp height is set by feeding the output of the bootstrap from the emitter of TR321, via TR316, back to the timebase bistable. The base of TR313 is at about +2V, therefore when the base of TR314 goes more positive than this, the bistable is reset, turning on TR315 and discharging the B timebase charging capacitor. There is no hold-off capacitor in the reset circuit (see Sec. 4.1.4., timebase A), because when timebase B resets, it resets bistable TR116/TR117 on the function board. This turns on TR110, stopping any further trigger pulses affecting timebase B bistable. Hence timebase B has the remainder of the 'A' sweep period, plus the hold-off time allowed for the 'A' sweep to recover. The 'B' bright-up waveform is taken from the collector of TR315, via TR317. The reset to bistable, TR116/TR117, is taken from the collector of TR315, via C316.

4.4 EXTERNAL X, EXTERNAL TRIGGER AMPLIFIER

The EXT X socket is connected directly to the high impedance attenuator, R296, C202, R284 and C224. This attenuates by a factor of about 3 and has an input resistance of approximately 1MΩ. C224 is a trimmer to adjust the frequency response of the attenuator to be flat. The EXT. TRIG socket is connected to the input of the attenuator, via a capacitor, C324, The output of the attenuator is taken to the gate of an FET (TR220). D223 and D224 protect the amplifier from excessively high applied voltages. TR220 and TR219 are connected as a feedback amplifier in which the ratio, R293 + R294:R294, determines the voltage gain. This is set to about 1.2 times. The output is taken from the collector of TR219 and the potential at this point is adjusted by R287 to be zero. Three outputs are taken via R290 and R291 to the trigger selector switches, S3 and S4, and another via R288 to the timebase switch.

4.5 POWER SUPPLY REQUIREMENTS

The plug in operates from the +12V, -12V and 150V supply lines generated in the main frame.

The current drawn from each is approximately:

+12V,	170mA
-12V,	200mA
+150V,	20mA

The procedure adopted for a complete failure will be described.

5.1 FAULT LOCATION

The circuit can be divided into four basic sections.

(a) Timebase A

(b) Timebase B

(c) Display switch and gates

(d) Single shot bistable and comparator circuit.

Assuming a complete loss of trace, the following sequence of investigation should be followed, referring to the circuit diagrams and circuit description for details of correct operation as necessary:–

5.1

(1) Plug unit into OS2000 or OS2100 Main frame via a suitable extension lead. Any Y unit can be used.

(2) Select "FREE RUN" and turn 'A' and 'B' range controls to 0.5mS/cm.

(3) Observe waveform on R248 (either end). This should be sawtooth going between ground and +4.5V. If this is not so, check bistable TR206/TR207 and TR211, the timebase gate transistor, as well as the ramp amplifier, in accordance with the circuit description.

(4) If a trace still cannot be obtained, check waveform on junction, D102/D119. This should be the sawtooth. If not, check potential at junction, D112/D109. This should be -12V. If not, check TR101.

(5) Having obtained the correct timebase waveform the comparator circuit can be checked. Set A sweep range to 0.5mS/cm and B sweep range to 0.2mS/cm. Select A intensified by B (Gated). This removes the +150 volts from R158 and D136, enabling TR113 to switch. Turn B level control to one extreme in order to prevent the B timebase from triggering. Observe the collector of TR113. The width of the 24V (-12V to +12V) positive-going pulse should be adjustable with the delay control. If no waveform is obtained, check the wiper voltage of the helical potentiometer. This should run approximately from ground to +4V.

(6) Check bistable, TR116/TR117, to see if it is being set and reset by timebase A.

(7) Check waveform on the base of TR111. This should be about 0.5V high, width being adjustable with the delay potentiometer.

(8) Check 'B' inhibit line (collector of TR110) and the collector of TR109. TR109 waveform should be 24 volts, with width variable by delay potentiometer when A intensified by B (sweep) is selected.

(9) Check timebase B waveform on R381. This should be a ramp of +4.5V amplitude. If not, check state of timebase gate, TR315; bistable, TR313/TR315, and reset system, TR316, as for timebase A.

(10) Select B DELAYED BY A (SWEEP), 'B' sweep should be displayed. If not, check gate, D101/D102/R117; diodes, D114/D117; and TR103. Check for 'B' bright-up pulse on TR105, collector and emitter.

(11) Reset timebase A and B ranges to 0.5mS/cm. Apply signal to Y amplifier (about 1kHz, 4cm amplitude), Switch to internal trigger with A LEVEL control on AUTO. Displayed waveform should be stable. If not, check that timebase A bistable is not free running, by rotating the level control fully clockwise. If trace does not disappear, check wiring to trigger selector switch and D205. (The end of D205 is connected to ground in all but the free run position). If displayed waveform disappears, check trigger circuit, TR204/TR205, for correct adjustment. If there is no display in the AUTO mode, check TR204, TR205 and associated components. Turn R219 and R216 to maximum resistance. A display should then be achieved. Set up trigger sensitivity and hold off time (5.2.5., 5.2.6).

(12) Having achieved stable triggering, switch to SINGLE SHOT and check for correct operation. If faulty, check single shot circuits in accordance with circuit description.

(13) Return to NORMAL (repetitive) display and set timebase B to 0.2mS/cm. Check that a small section of the display remains at normal brightness and that the contrast control operates. If not, check waveforms on the collector of TR107 and check gate, D120/D121. Waveform on TR107 should be negative-going lasting for the period of timebase A, with its level adjustable by the contrast control. Superimposed on it is a further negative-going pulse lasting for the period of timebase B (OS2000 Main Frame only).

(14) With a trigger signal applied to the B time base trigger amplifier, check 'B' trigger system by switching to 'A INTEN BY B' (gated) and rotating the B LEVEL control. The bright portion should appear and disappear. If not, check for the presence of a trigger waveform on the collector of TR309 and check that the potential of TR309 collector can be adjusted to +6V with the level control. Observe trigger circuit output waveform with an oscilloscope (collector of TR312) and rotate level control. Check that the 'B' trigger is not inhibited by current through R356 (that junction D310/R356, does not remain negative throughout the 'A' sweep period).

5.2. RECALIBRATION

5.2.1 Plug the unit into a calibrated OS2000, OS2100 or OS2200 series main frame with a calibrated OS2002Y. The OS2005AX should be coupled by a suitable extension lead to the timebase socket, Switch on supply.

5.2.2 With TRIG. SELECT in FREE RUN and TIME/CM switch in the locked position, the right hand neon should be lit (A ONLY). On pulling out and turning the knob, the delay function neon should light and the A ONLY neon go out.

5.2.3 TIMEBASE A TRACE LENGTH

Return TIME/CM switch to locked position at 1mS/cm. Set trigger selector to FREE RUN, trigger coupling to AC, trigger mode to NORMAL and A LEVEL in AUTO. A trace should now appear on screen. Feeding 1mS markers to Y input and adjusting fine velocity for 1 pulse/cm, adjust timebase A trace length (R234) for 11.5cm.

5.2.4 HOLD OFF

With TIME/CM set to .5mS/cm, set (TRIG.SENS) R216 to maximum. Connect an oscilloscope to the ramp socket, using the X10 probe. Adjust R219 (HOLD OFF). for a hold off time of 20% of total ramp cycle.

5.2.5 TRIGGER SENSITIVITY 'A'

With unit in 'INT' +' trig.position, TIME/CM set to .5mS/cm, level control in AUTO and Y atten set to .05V/cm; apply to Y input 10mV from square wave calibrator and adjust R216 (TRIG SENS) so that trace beats slowly, then adjust until trace just locks. Switch channel selector to Y1 and Y2 position and TIME/CM to 50μS/cm. Check that with the 2mm display, the trace locks over a range of 2mS/cm – 1mS/cm in the correct mode both +ve and -ve.

5.2.6 Remove signal from Y input, ground the input switches and check that while in Y1 and Y2 position with TIME/CM in 1mS/cm, the Schmitt trigger does not run faster than 30Hz. i.e. trace does not beat too fast.

5.2.7 Switch to FREE RUN and check that over the whole range of timebase speeds, there are two traces on the screen simultaneously.

5.2.8 CENTRE LEVEL CONTROL A

With a 0.5cm 1kHz Y signal, trigger source set to INTernal and trigger coupling to AC, adjust R274 to achieve trigger with level control central. Check that voltages on pin 1 and 2 are equal (This potential difference can be reduced to zero with the Y plug-in DC trigger balance pre-set.

5.2.9 AC, HF REJ. DC TRIGGER COUPLING

Set time base range to 0.2μS/cm, and apply a 100kHz fast rise time square wave to the Y amplifier. Set the trigger coupling to AC, and obtain a display showing the leading edge of the square wave. Switch to HF. REJ. and check that the leading edge is no longer visible. Check DC trigger by applying a very low frequency sine wave (10Hz) to one Y input (DC coupled) and observing that the trigger sensitivity is the same for this signal and one of the same amplitude at higher frequency (1kHz).

5.2.10 EXT and LINE

Switch to EXT trig and apply 200mV from square wave calibrator to Y input and EXT trig socket; check that display locks in both +ve and -ve modes. Switch to LINE and apply to Y input the line frequency: check that it locks in both +ve and -ve modes.

5.2.11 TIMEBASE A.

With TIME/CM set to 1mS/cm CAL, 1mS marker pulses fed to Y input and manual trigger, adjust R253 (SET SPEED A) for 1 pulse/cm. Switch to 1μS/cm and adjust C218 for 1 pulse/cm with 1μS markers fed to Y unit.

NOTE. Trace Length and Set Speed controls are completely independent on timebase A.

5.2.12 Check all 19 ranges to within ±3%.

5.2.13 Check that 'A' VARIABLE reduces speed by greater than 3:1. Check X5 magnifier.

5.2.14 EXT X GAIN

Switch TIME/CM to EXT position and apply to EXT X socket, 5V from square wave calibrator. Adjust R294 (SET X GAIN) for a 5cm display, now adjust C224 to remove out-going or in-going tail at extreme ends of the display. Remove input signal and turn TIME/CM to 10mS/cm; adjust X shift control to bring left-hand end of trace to the centre graticule line, switch TIME/CM back to EXT position and set the spot to centre by means of R287.

Recheck X gain after setting the spot to centre and if necessary, re-adjust R294 to bring X gain into spec (±3%).

5.2.15 Set trig selector to FREE RUN, timebase A to 1mS/cm and timebase B to .5mS/cm. Set DELAY pot. to No.2 (2 turns clockwise). Adjust CONTRAST pre-set on front panel to give good visibility of dim and bright portions of trace.

5.2.16 TIMEBASE B CALIBRATION

Set trig selector to INT +, timebase A to 2mS/cm, trigger coupling to AC, sweep to NORMAL and DELAY pot. to between 0 and 1.
Feed 1mS marker pulse to Y input, trigger A time base manually, switch timebase B to 1mS/cm and select 'B DELAYED BY A SWEEP'. Adjust R376 (SET SPEED B) for 1 pulse/cm, now adjust R370 (B TRACE LENGTH) for 11.5cm.

Switch TIME/CM to locked position; set timebase A to 2μS/cm and timebase B to 1μS/cm. Feed 1μS marker pulses to Y input and select 'B DELAYED BY A SWEEP'.

Adjust C318 (SET 1μS) for 1 pulse/cm. Check all ranges to be within ±3%.

NOTE. Timebase B range is from 100mS/cm to 0.2μS/cm only.

5.2.17 'B' LEVEL CENTRE

Set TRIG. SELECT to FREE RUN, remove input signal, set A LEVEL to AUTO, timebase A to 1mS/cm, to, .5mS/cm and R349 (B TRIG SENS) to max. resistance. Select 'B DELAYED BY A GATED' and operate B LEVEL control to obtain trace. Centralise B LEVEL control (Spot vertical) and adjust R337 (B LEVEL CENTRE) to obtain trace.

5.2.18 'B' TRIG. SENSITIVITY

With timebase A and B set as above, put A and B trig. selectors to INT + and A TRIG. LEVEL to AUTO, Apply a 1kHz square wave to the Y input with an amplitude of 4mm, select 'A INTEN BY B GATE' and adjust R349 (B TRIG SENS) so that timebase B just triggers in both +ve and -ve modes. Check that trigger drops out at 3mm and also check that while operating DELAY pot. in +ve trigger mode, timebase B triggers only on the positive portion of the square wave. i.e. instead of running along smoothly, it jumps from one positive-going portion to the next.

5.2.19 SINGLE SHOT

Return TIME/CM to locked position, switch to .5mS/cm with A TRIG SELECT switched to INT +. Feed 1kHz

sine wave to Y input with an amplitude of approx. 3cm, triggered manually. Switch to SINGLE SHOT, turn A LEVEL control fully clockwise and move lever to "ARM" position. The neon should light. Rotate A LEVEL control until ARM light goes out. Each "ARM" operation should give a single sweep of the timebase. Do this repeatedly, checking for phase shift between sweeps.

5.2.20 DELAY POSITION

Set TRIG. SELECT to FREE RUN, timebase A to .5mS/cm, timebase B to 2μS/cm and DELAY pot. to zero. Adjust BRILL to achieve good visibility with timebase B, with display switch in A INTENSIFIED BY B (SWEEP).

Adjust R141 to bring brightened portion of trace 0.2cm from the start of 'A' sweep. Set brightened portion to extreme left-hand graticule line by means of X shift control. Turn DELAY pot. to 10 and adjust R144 to bring the bright spot to the extreme right-hand line. Repeat the above. The DELAY pot. should now be calibrated in centimeters of trace deflection.

5.2.21 JITTER FACTOR

Remove extension lead and insert plug-in direct into main frame. Set timebase A to 1mS/cm, timebase B to .5μS/cm and apply 1mS marker pulse to Y input, adjusting A LEVEL control to obtain a stationary display. Set DELAY pot. to approx 9 so that a pulse edge is picked out by the bright-up. Select 'B DELAYED BY A SWEEP'. Observe jitter; it may be necessary to adjust the DELAY pot. fractionally so as to display the leading edge.

The maximum available delay is 10 X 1mS = 10mS and with time base B at 0.5μS/cm, 1cm of jitter is equivalent to 1/20,000th of the maximum available delay. Check that the jitter does not exceed 2cm (typical jitter is ½cm or 40,000:1).

5.2.22 Check 'A' and 'B' gate sockets for correct waveform.

5.2.23 Check 'A' trigger sensitivity (5.25) with plug-in direct in main frame. It may be found that trigger is more sensitive without extension lead but should not be more sensitive than 2mm.

OS2005AX TIME BASE 'A'

RESISTORS

Ref	Value	Description	Tol ± %	Rating	Part No
R201	1k		5	1/8W	384
R202	1k		5	1/8W	384
R203	2k2		5	1/8W	425
R204	6k8		5	1/8W	313
R205	6k8		5	1/8W	313
R206	100		5	1/8W	11504
R207	100		5	1/8W	11504
R208	100		5	1/8W	11504
R209	100		5	1/8W	11504
R210	100		5	1/8W	11504
R211	100		5	1/8W	11504
R212	1k2		5	1/8W	2087
R213	1k		5	1/8W	384
R214	270k		5	1/8W	1679
R215	100		5	1/8W	11504
R216	100	Plessey MPD/PC			28520
R217	33		5	1/8W	2931
R218	10		5	1/8W	2259
R219	470	Plessey MPD/PC			28524
R220	47k		5	1/8W	318
R221	3k3		5	1/8W	1638
R222	1k8		5	1/8W	310
R223	10		5	1/8W	2259
R224	3k9		5	1/8W	312
R225	470Ω		5	1/8W	1373
R226	4k7		5	1/8W	386
R227	47k		5	1/8W	318
R228	910		2		26735
R229	470		5	1/8W	1373
R230	1k5		5	1/8W	385
R231	10		5	1/8W	2259
R232	10		5	1/8W	2259
R233	1k5		5	1/8W	385
R234	4k7	Plessey MPD/PC			24560
R235	18k		5	1/8W	634
R236	2M2		5	1/8W	24838
R237	47		5	1/8W	727
R238	2k2		5	1/8W	425
R239	27k		5	1/8W	316
R240	560		5	1/8W	308
R241	4k7		5	1/8W	386
R242	1k		5	1/8W	284
R243	8k2		5	1/8W	314
R244	10k		5	1/8W	11503
R245	12k		5	1/8W	1685
R246	270		5	1/8W	2716
R247	1k8		5	1/8W	310
R248	100		5	1/8W	11504
R249	15k		5	1/2W	18564
R250	10k		5	1/2W	18562
R251	270		5	1/8W	2716
R252	560		5	1/8W	308
R253	4k7	Plessey MPD/PC			24560
R255	1k		5	1/8W	384
R256	3k3		5	1/8W	1638
R257	1k5		5	1/8W	385
R258	10		5	1/8W	2259
R259	1k2		5	1/8W	2087
R263	8k2		5	6W	19802
R264	10k		5	1/8W	11503
R263	8k2		5	1/8W	11503
R266	1k		5	1/8W	384
R267	100		5	1/8W	11504
R268	2k2		5	1/8W	425
R269	10		5	1/8W	2259
R270	10		5	1/8W	2259
R271	1k		5	1/8W	384
R272	1k		5	1/8W	384
R273	680		5	1/8W	309
R274	4k7	Plessey MPD/PC			24560
R275	10k		5	1/8W	11503
R276	12k		5	1/8W	1685
R277	1k		5	1/8W	384
R278	1k		5	1/8W	384
R279	3k3		5	1/8W	1638
R280	1k5		5	1/8W	385
R281	100		5	1/8W	11504
R282	33k		5	1/8W	317
R283	3k3		5	1/8W	1638
R284	330k		5	1/8W	2521
R285	1k		5	1/8W	384
R286	1k		5	1/8W	384
R287	4k7	Plessey MPD/PC			24560
R288	100Ω		5	1/8W	11504
R290	3k3		5	1/8W	1638
R291	3k3		5	1/8W	1638
R292	2k2		5	1/8W	425
R293	6k8		5	1/8W	313
R294	4k7	Plessey MPD/PC			24560
R295	1k		5	1/8W	384
R296	680k		5	1/2W	18584
R297	33k		5	1/8W	317
R298	33k		5	1/8W	317
R299	3k3		5	1/8W	1638

CAPACITORS

C201	.01μF		400V	2385
C202	10pF			22364
C203	.01μF			22395
C204	.01μF			22395
C205	100pF			22376
C206	.01μF			22395
C207	18pF			22367
C208	1000pF			22387
C209	.01 μF			22395
C210	.01 μF			22395
C211	.01 μF			22395
C212	47pF			22372
C213	330pF			22381
C214		A.O.T		
C215	39pF			22371

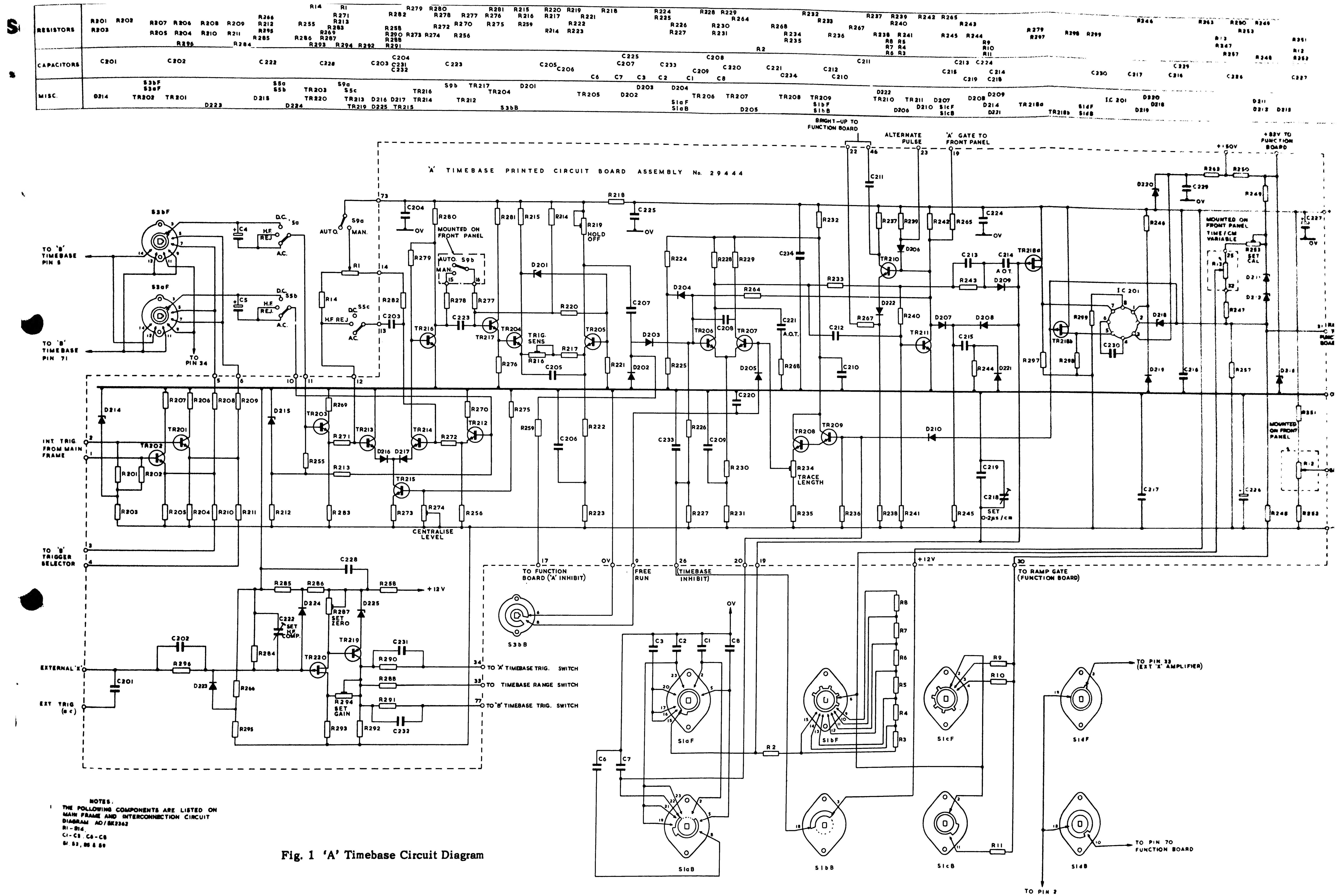
OS2005AX TIME BASE 'A' *(cont)*

Ref	Value	Description	Tol ± %	Rating	Part No
C214					
C215	39pF				22371
C216	.1=μF			160V	2740
C217	.01μF				22395
C218	6/25pF	Trimmer			23593
C219	68pF				22374
C220	.01 μF				22395
C221			A.O.T		
C222	6/25pF		TRIMMER		23593
C223	2.2μF				25738
C224	.01μF				22395
C225	.01μF				22395
C226	25μF	ELECTROLYTIC		25V	20776
C227	25μF			25V	20776
C228	.01μF				22395
C229	.01μF				22395
C230	220pF				22379
C231	6.8pF				22361
C232	6.8pf				22361
C233	220pF				22379
C234	.1μF			160V	2740
C235	100pF				22376
C236	100pF				22376
C237	1000pF				22387

TRANSISTORS

TR201		BSX20		23307
TR202		BSX20		23307
TR203		BSX20		23307
TR204		BSX20		23307
TR205		BSX20		23307
TR206		BSX20		23307
TR207		BSX20		23307
TR208		BSX20		23307
TR209		BSX20		23307
TR210		BSX20		23307
TR211		BSX20		23307
TR212		BSX20		23307
TR213		BSX20		23307
TR214		BSX20		23307
TR215		BSX20		23307
TR216		BSX20		23307
TR217		BC108		26110
TR218		2N3955	F.E.T	27602
TR219		2N3905		20818
TR220		UC734	F.E.T	24832
D201	6V2	Zener		4032
D202		OA95		23318
D203		IN4148		23802
D204		OA95		23318
D205		OA95		23318
D206		1N4148		23802
D207		1N4148		23802
D208		1N4148		23802
D209		1N4148		23802

Ref	Value	Description	Tol ± %	Rating	Part No
D210		1N4148			23802
D211		1N3497 (Zener)			29601
D212		1N3497 (Zener)			29601
D213		1N983B (Zener)			26842
D214	2V7	Zener			21002
D215	4V7	Zener			4073
D216		1N4148			23802
D217		1N4148			23802
D218	9V1	Zener			4667
D219	8V2	Zener			3798
D220	8V2	Zener			3798
D221		OA95			23318
D222		1N4148			23802
D223		1N4148			23802
D224		1N4148			23802
D225	2V7	Zener			21002
IC201		SL702C			30214
L201		Ferrite FX 1242			26986
L202		Ferrite FX 1242			26986
L203		Ferrite FX 1242			26986



NOTES.
1 THE FOLLOWING COMPONENTS ARE LISTED ON MAIN FRAME AND INTERCONNECTION CIRCUIT DIAGRAM AO/SK2362
R1 - R14
C1 - C3, C6 - C8
S1, S3, S5 & S9

Fig. 1 'A' Timebase Circuit Diagram

OS2005AX TIME BASE 'B'

RESISTORS

Ref	Value	Description	Tol ± %	Rating	Part No
R319	3k3		5	1/8W	1638
R320	3k3		5	1/8W	1638
R321	33k		5	1/8W	317
R322	33k		5	1/8W	317
R323	1k		5	1/8W	384
R324	1k		5	1/8W	384
R325	2k2		5	1/8W	425
R326	2k2		5	1/8W	425
R327	3k3		5	1/8W	1638
R328	3k3		5	1/8W	1638
R329	10		5	1/8W	2259
R330	680		5	1/8W	309
R331	1k2		5	1/8W	2087
R332	2k2		5	1/8W	425
R333	10		5	1/8W	2259
R334	1k		5	1/8W	384
R336	33k		5	1/8W	317
R337	4k7	Plessey MPD/PC			24560
R338	1k		5	1/8W	384
R339	10		5	1/8W	2259
R340	2k2		5	1/8W	425
R341	10k		5	1/8W	11503
R342	3k3		5	1/8W	1638
R343	1k5		5	1/8W	385
R344	33k		5	1/8W	317
R345	10		5	1/8W	2259
R346	100		5	1/8W	11504
R347	470		5	1/8W	1373
R348	33		5	1/8W	2931
R349	100	Plessey MPD/PC			28520
R350	3k3		5	1/8W	1638
R351	3k9		5	1/8W	312
R352	470		5	1/8W	1373
R353	910		2		26735
R354	470		5	1/8W	1373
R355	1k8		5	1/8W	310
R356	4k7		5	1/8W	386
R357	47k		5	1/8W	318
R358	1k5		5	1/8W	385
R359	1k5		5	1/8W	385
R360	560		5	1/8W	308
R361	4k7		5	1/8W	386
R362	100		5	1/8W	11504
R363	10k		5	1/8W	11503
R364	8k2		5	1/8W	314
R365	12k		5	1/8W	1685
R366	1k		5	1/8W	384
R367	47		5	1/8W	727
R368	100		5	1/8W	11504
R369	1k		5	1/8W	384
R370	4k7	Plessey MPD/PC			24560
R371	18k		5	1/8W	634
R372	100		5	1/8W	11504
R373	100		5	1/8W	11504
R374	910		2		26735
R375	3k3		5	1/8W	1638
R376	4k7	Plessey MPD/PC			24560
R377	560		5	1/8W	308
R378	100		5	1/8W	11504
R379	10k		5	1/8W	11503
R380	27k		5	1W	19054
R381	100		5	1/8W	11504
R382	10		5	1/8W	2259
R383	10		5	1/8W	2259
R386	10k		5	1/8W	11503
R388	10k		5	1/8W	11503

CAPACITORS

C301	.01μF				22395
C302	1000pF				22387
C303	1000pF				22387
C306	.01μF				22395
C307	.01μF				22395
C308	100pF				22376
C309	18pF				22367
C310	.01μF				22395
C311	100pF				22376
C312	.01pF				22395
C313	47pF				22372
C314	330pF				22381
C315		A.O.T			
C316	39pF				22371
C317	.01μF				22395
C318	6/25pF	Trimmer			23593
C319	68pF				22374
C320	.01μF				22395
C321	.01μF				22395
C322	.01μF				22395
C323	.01μF				22395
C325	39pF				22371
C326	.01μF				22395
L301		Ferrite FX 1242			26986
L302		Ferrite FX 1242			26986
L303		Ferrite FX 1242			26986

TRANSISTORS

TR304		BSX20			23307
TR305		BC 108			26110
TR306		BSX20			23307
TR307		BSX20			23307
TR308		BC 108			26110
TR309		BSX20			23307
TR310		BSX20			23307
TR311		BSX20			23307
TR312		BSX20			23307
TR313		BSX20			23307
TR314		BSX20			23307
TR315		BSX20			23307
TR316		BSX20			23307

OS2005AX TIME BASE 'B' *(Cont)*

Ref	*Value*	*Description*	*Tol ±*	*Rating*	*Part No*
TR317		BSX20			23307
TR318		UC734			24832
TR319		BSX20			23307
TR320		2N3905			20818
TR321		2N3905			20818
D301	4V7	Zener			4073
D302		1N4148			23802
D303		1N4148			23802
D304	6V2	Zener			4032
D305		OA95			23318
D306		1N4148			23802
D307		1N4148			23802
D308		OA95			23318
D309		OA95			23318
D310		1N4148			23802
D311		1N4148			23802
D312		1N4148			23802
D313		1N4148			23802
D314	6V2	Zener			4032
D315	6V8	Zener			4666
D316	6V2	Zener			4032
D318		OA95			23318
D319		1N4148			23802

RESISTORS	R322 R321 R325 R328 R326 R324 R323 R25 R327 R333 R24 R332 R320 R330 R336 R337 R338 R339 R319 R342 R343 R340 R341 R329 R346 R347 R348 R344 R349 R350 R345 R355 R351 R352 R357 R353 R354 R358 R382 R383 R388 R366 R359 R360 R362 R363 R365 R386 R364 R368 R367 R369 R370 R361 R371 R372 R373 R380 R379 R375 R374 R376 R378 R377 R381 R18 R16 R17 R18 R19 R20
CAPACITORS	C14 C15 C302 C303 C301 C306 C307 C308 C310 C309 C312 C311 C313 C316 C314 C325 C315 C317 C320 C318 C319 C13 C12 C11 C10 C326 C323 C321 C322
MISC	S4aF S4bF S4a S4b L1 D301 TR305 TR306 S4c D302 D303 TR304 TR307 TR308 TR309 TR310 TR311 D304 TR312 D310 D306 D305 D309 D307 TR313 TR314 D308 TR315 TR316 D311 D312 D313 TR317 D319 TR318 TR319 TR320 D314 D316 D315 TR321 S2aF S2aB S2bF S2bB

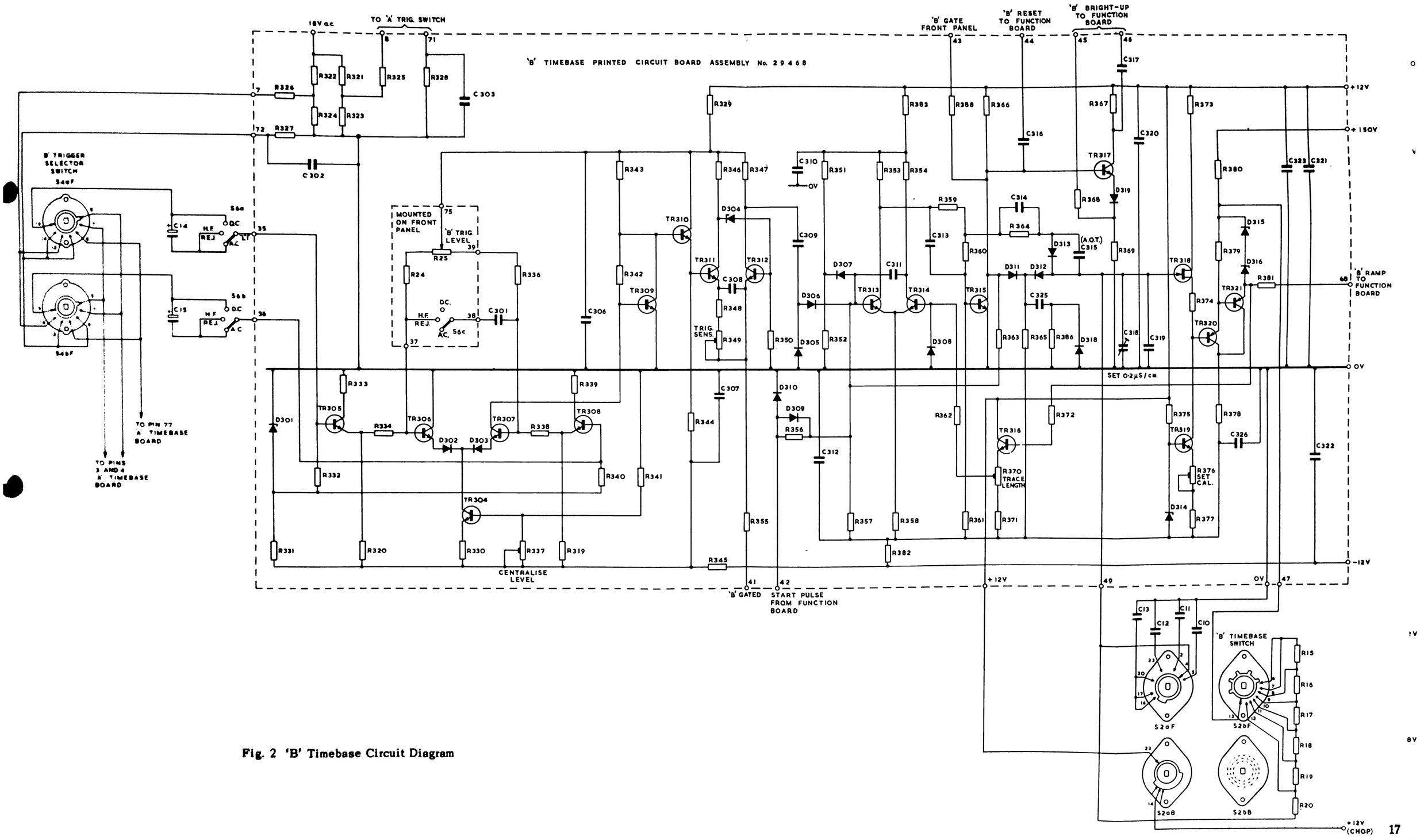


Fig. 2 'B' Timebase Circuit Diagram

OS2005AX FUNCTION BOARD

RESISTORS

Ref	Value	Description	Tol ± %	Rating	Part No
R101	68k		5	1/8W	1636
R102	10		5	1/8W	2259
R103	10		5	1/8W	2259
R104	100k		5	1/8W	319
R105	12k		5	1/8W	1685
R107	12k		5	1/8W	1685
R108	12k		5	1/8W	1685
R109	4k7		5	1/8W	386
R110	12k		5	1/8W	1685
R111	12k		5	1/8W	1685
R113	12k		5	1/8W	1685
R117	6k8		5	1/8W	313
R118	6k8		5	1/8W	313
R119	82k		5	1/8W	2088
R120	68k		5	1/8W	1636
R121	150k		5	1/8W	4018
R122	150k		5	1/8W	4018
R123	100k		5	1/8W	319
R124	10k		5	1/8W	11503
R125	4k7		5	1/8W	386
R126	470		5	1/8W	1373
R127	33k		5	1/8W	317
R128	3k3		5	1/8W	1638
R129	10k		5	1/8W	11503
R130	10k		5	1/8W	11503
R131	2k7		5	1/8W	311
R132	10k		5	1/8W	11503
R133	3k9		5	1/8W	312
R134	4k7		5	1/8W	386
R135	68k		5	1/8W	1636
R136	8k2		5	1/8W	314
R137	12k		5	1/8W	1685
R138	22k		5	1/8W	1544
R141	470	Plessey MPD/PC			28524
R142	8k2		5	1/8W	314
R143	1k		5	1/8W	384
R144	4k7	Plessey MPD/PC			24560
R145	3k9		5	1/8W	312
R146	2k7		5	1/8W	311
R147	4k7		5	1/8W	386
R148	12k		5	1/8W	1685
R149	2k7		5	1/8W	311
R150	6k8		5	1/8W	313
R151	6k8		5	1/8W	313
R152	27k		5	1/8W	316
R153	27k		5	1/8W	316
R154	10k		5	1/8W	11503
R155	10k		5	1/8W	11503
R156	100		5	1/8W	11504
R157	10k		5	1/8W	11503
R158	100k		5	1/8W	319
R159	12k		5	1/8W	1685
R162	12k		5	1/8W	1685

CAPACITORS

Ref	Value	Description	Tol ± %	Rating	Part No
C103	.01µF				22395
C106	47pF				22372
C107	.01µF				22395
C108	47pF				22372
C109	47pF				22372
C110	18pF				22367
C111	.1µF			30V	19647
C112	.01µF				22395

TRANSISTORS

TR101		C424			21871
TR102		2N2639			23307
TR103		C424			21871
TR105		2N2639			23307
TR106		2N2639			23307
TR107		BF170			24745
TR108		2N2639			23307
TR109		2N3905			20818
TR110		2N2639			23307
TR111		2N2639			23307
TR112		2N2639			23307
TR113		2N3905			20818
TR114		C407			20388
TR115		2N2639			23307
TR116		2N2639			23307
TR117		2N2639			23307

D101		1N4148			23802
D102		1N4148			23802
D103		1N4148			23802
D104		1N4148			23802
D109		1N4148			23802
D110		1N4148			23802
D111		1N4148			23802
D112		1N4148			23802
D113		1N4148			23802
D114		1N4148			23802
D115		1N4148			23802
D116		1N4148			23802
D117		1N4148			23802
D118		1N4148			23802
D119		1N4148			23802
D120		1N4148			23802
D121		1N4148			23802
D122		1N4148			23802
D123		1N4148			23802
D124		1N716 (Tunnel)			26841
D125		OA 47			4468
D126		1N4148			23802
D127		1N4148			23802
D128		1N4148			23802
D129		1N4148			23802
D130		1N4148			23802
D131		1N3497			29601

OS2005AX FUNCTION BOARD *(cont)*

Ref	*Value*	*Description*	*Tol ±%*	*Rating*	*Part No*
D132		1N4148			23802
D133		1N4148			23802
D135		1N4148			23802
D136		1N4148			23802
D137		1N4148			23802
IC101		MC1429G			28882

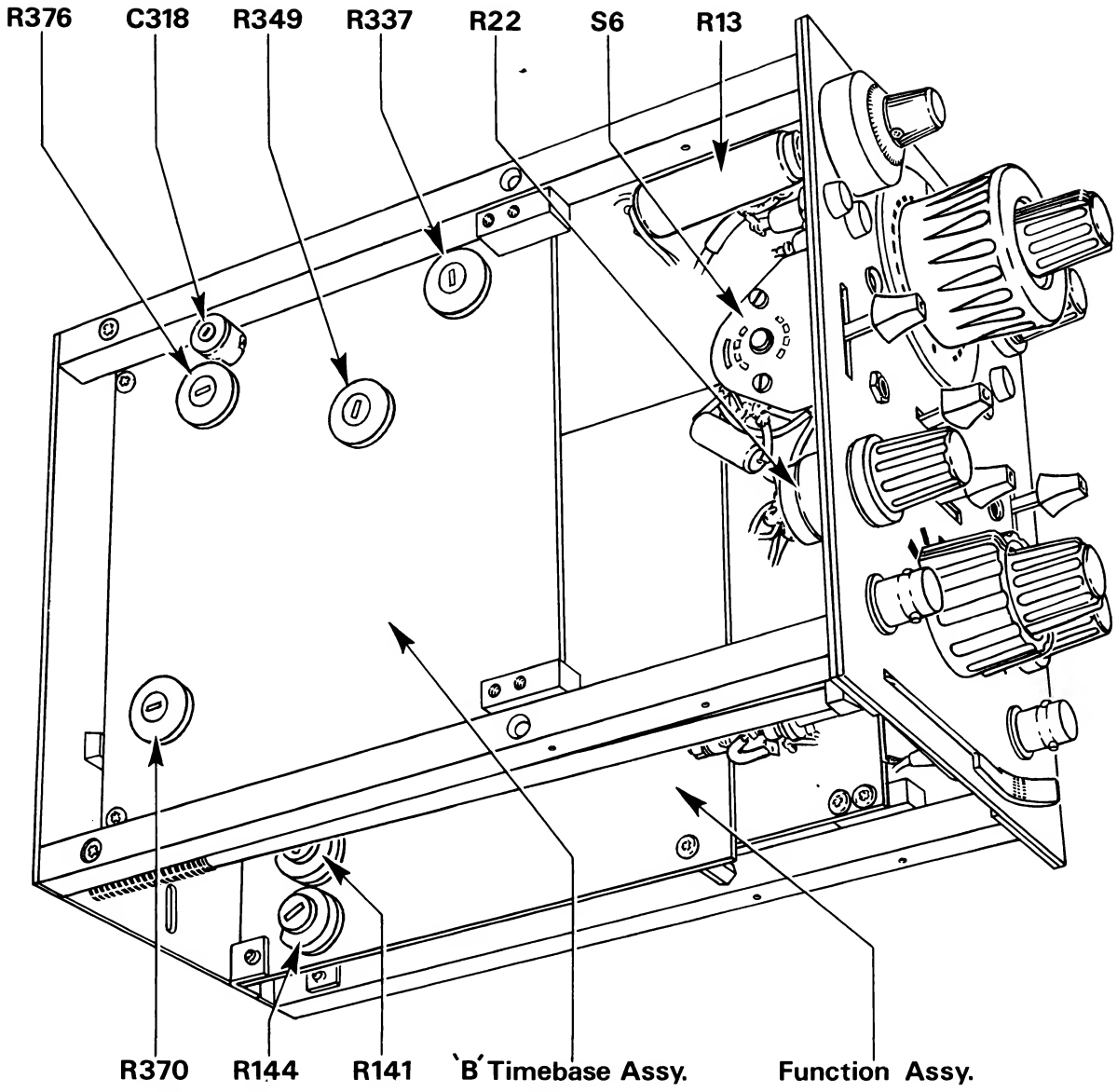


Fig. 3 Component Layout (L/H View)

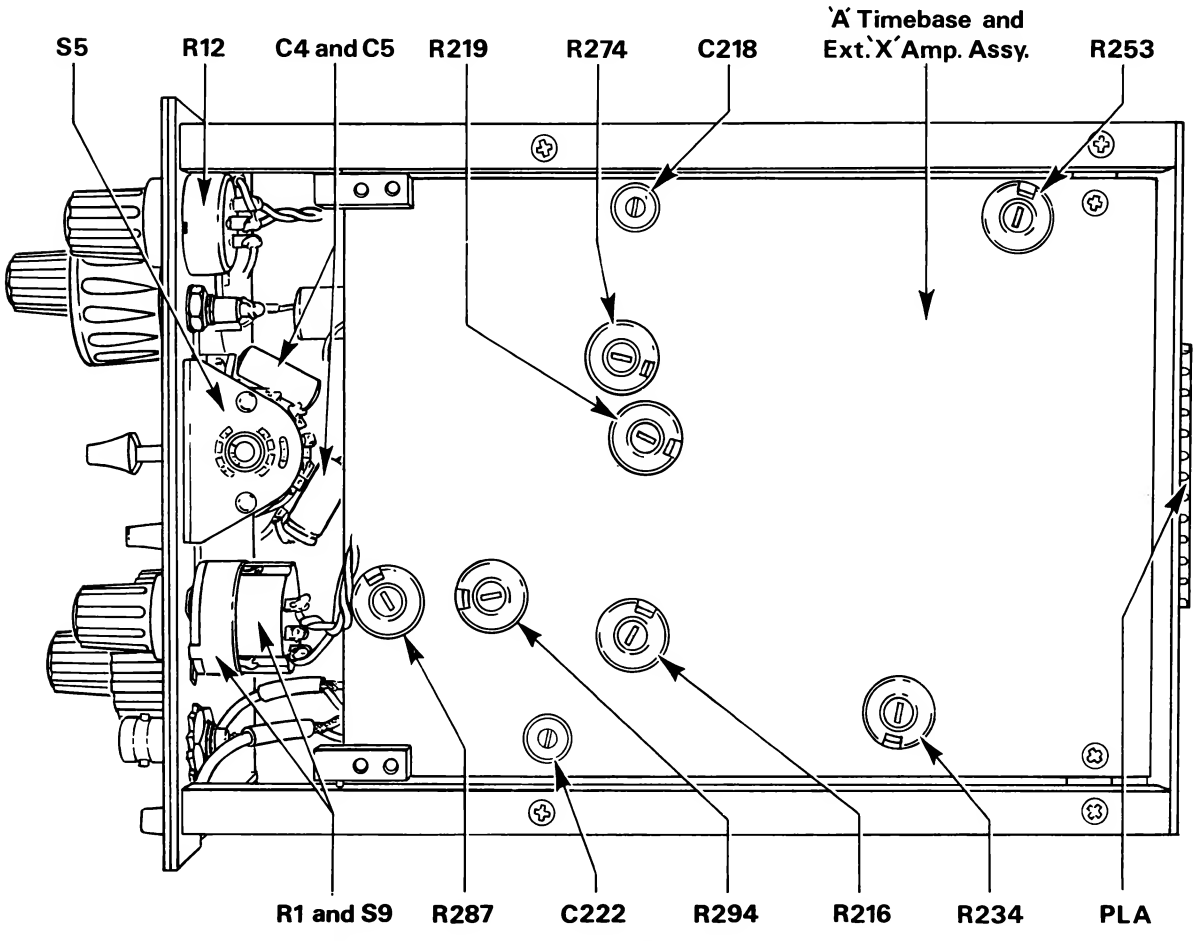


Fig. 4 Component Layout (R/H View)

RESISTORS

R101 R102 R103 R104 R105 R106 R107 R108 R109 R110 R111 R112 R113 R114 R115 R116 R117 R118 R119 R120 R121 R122 R123 R124 R125 R126 R127 R128 R129 R130 R131 R132 R133 R134 R135 R136 R137 R138 R139 R140 R141 R142 R143 R144 R145 R146 R147 R148 R149 R150 R151 R152 R153 R154 R155 R156 R157 R158 R159 R162

CAPACITORS

C101 C102 C103 C104 C105 C106 C107 C108 C109 C110 C111 C112

MISC

N1 N2 N3 TR101 TR102 TR103 TR104 TR105 TR106 TR107 TR108 TR109 TR110 TR111 TR112 TR113 TR114 TR115 TR116 TR117 D101 D102 D103 D104 D105 D106 D107 D108 D109 D110 D111 D112 D113 D114 D115 D116 D117 D118 D119 D120 D121 D122 D123 D124 D125 D126 D127 D128 D129 D130 D131 D132 D133 D134 D135 D136 D137 IC 101 S7a S7b S8 S11

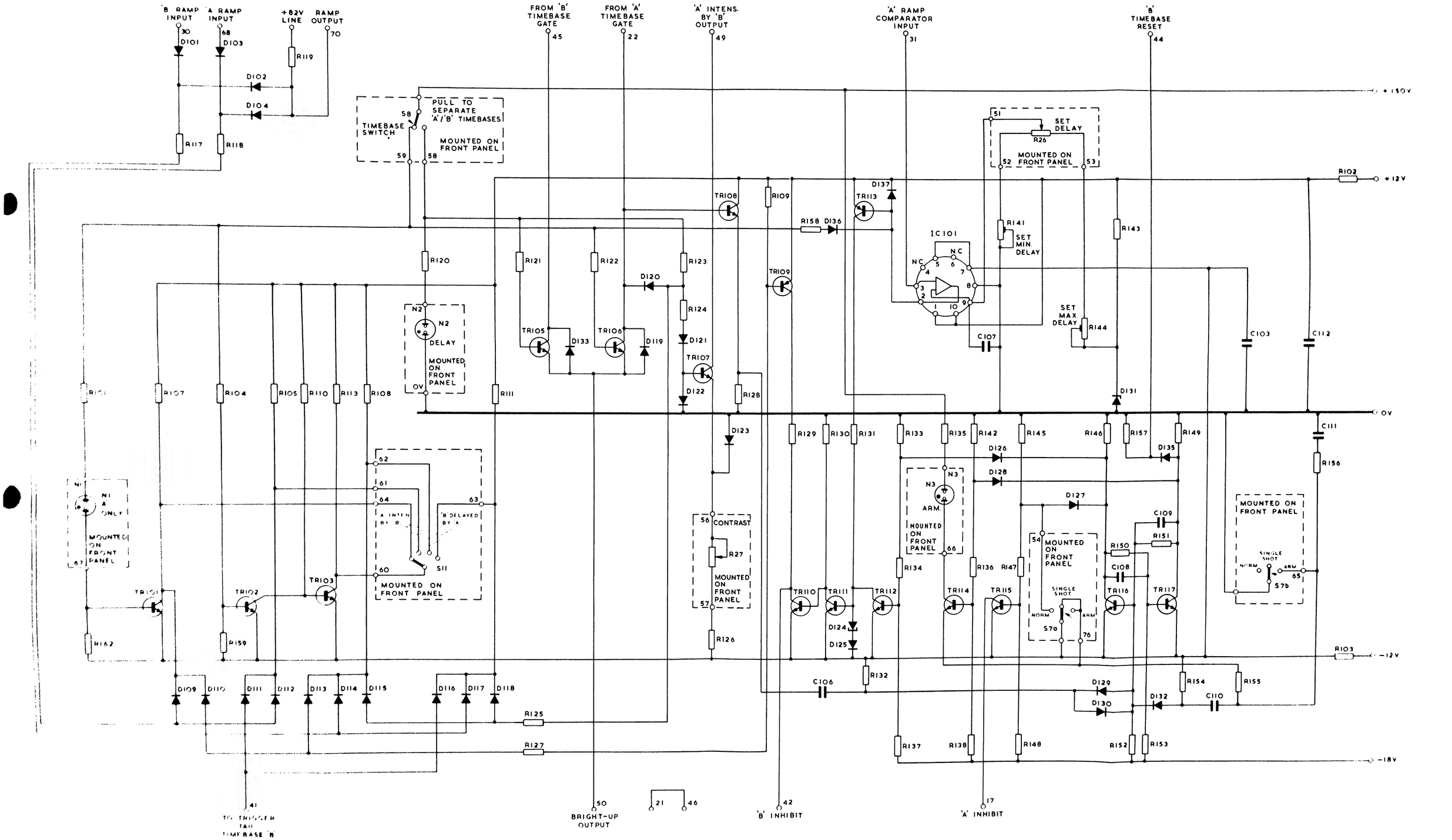


Fig. 5 Function Board Timebase Circuit Diagram

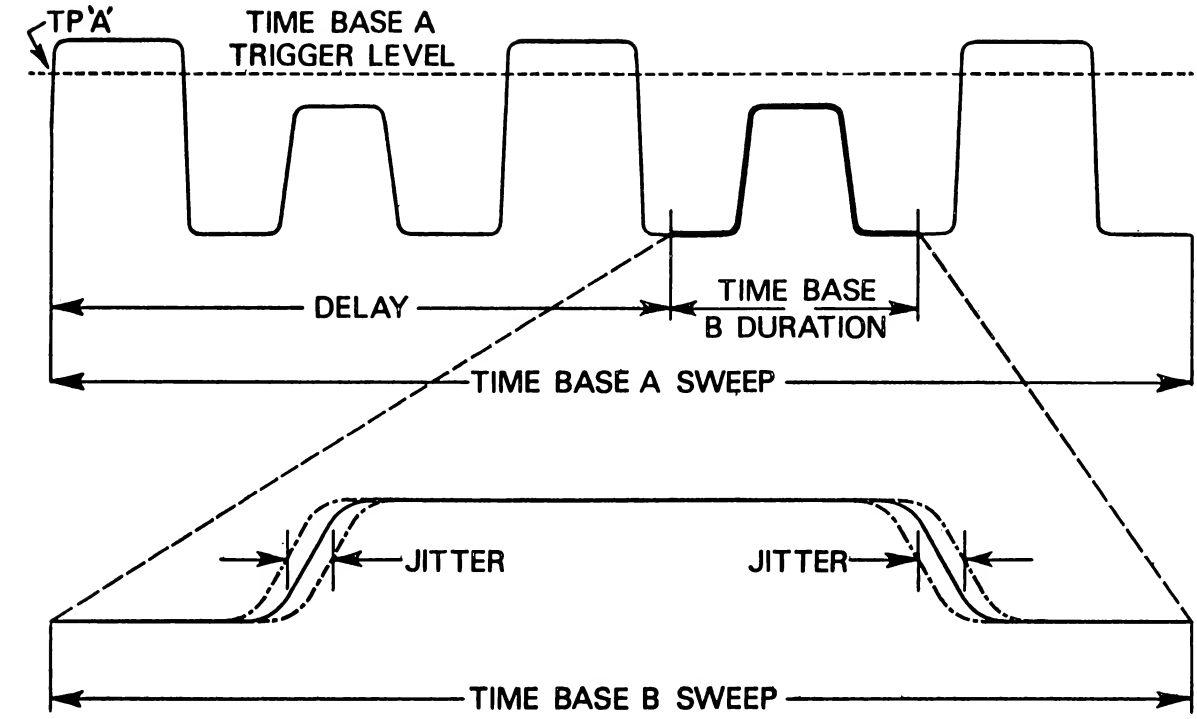
MAIN FRAME AND INTERCONNECTIONS FOR OS2005AX

RESISTORS

Ref	Value	Description	Tol ± %	Rating	Part No
R1	100k	WITH S9			A.23650
R2	55k8		1		26846
R3	83k7		1		26847
R4	138k6		1		26848
R5	278k1		1		26849
R6	837k		1		26850
R7	1M386		1		26851
R8	2M871		1		26852
R9	68k		5	1/8W	1636
R10	100k		5	1/8W	319
R11	62k		5		28817
R12	500				A.24587
R13	5k	PART OF S1, S2, S10			29756
R14	33k		5	1/8W	317
R15	1M54		1		24843
R16	931k		1		24845
R17	309k		1		24842
R18	154k		1		24841
R19	93k		1		24840
R20	62k		1		24839
R21	1k		5	1/8W	384
R24	33k		5	1/8W	317
R25	100k				A.26838
R26	5k	10 TURN			A4/26837
R27	5k				A4/30090

CAPACITORS

C1	.01μF			160V	24886
C1	.01μF			160V	24886
C2	.1μF		1	160V	24887
C3	1μF		1	160V	24888
C4	50μF			6V4	19954
C5	50μF			6V4	19954
C6	100pF				22376
C7	18pF				22367
C8	900pF		1	125V	24885
C9	33pF				22370
C10	900pF		1	125V	24885
C11	.01μF		1	160W	24886
C12	.1μF		1	160W	24887
C13	1μF		1	160V	24888
C14	50μF			6V4	19954
C15	50μF			6V4	19954
C16	1000pF				22387
C17	1000pF				22387
L1– L11		Ferrite FX 1242			26986
S1		WITH S2, S10, R13			29756
S2		WITH S1, S10, R13			29756
S3		WITH S3			29420
S4		WITH S4			29420
S5					A4/30094
S6					A4/30094
S7					A4/30095
S8					26839
S9		PART OF R1			A.23650
S10		WITH S1, S2, R13			29756
S11					A4/30096
SKA		BNC 50Ω			1222
SKB		BNC 50Ω			1222
SKC					26588
SKD					26588
SKE					26588
PLA					24852
N1		HIVAC 34H			26845
N2		HIVAC 34H			26845
N3		HIVAC 34H			26845



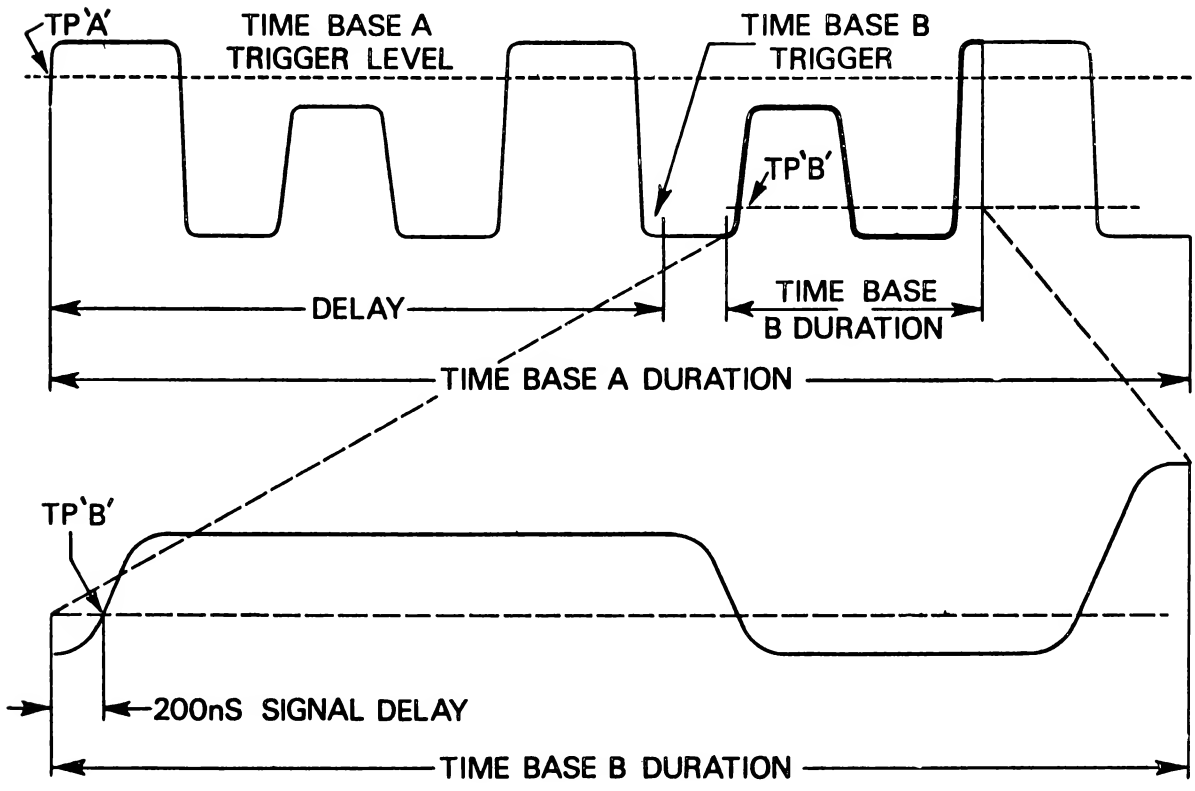


Fig. 6 Waveforms

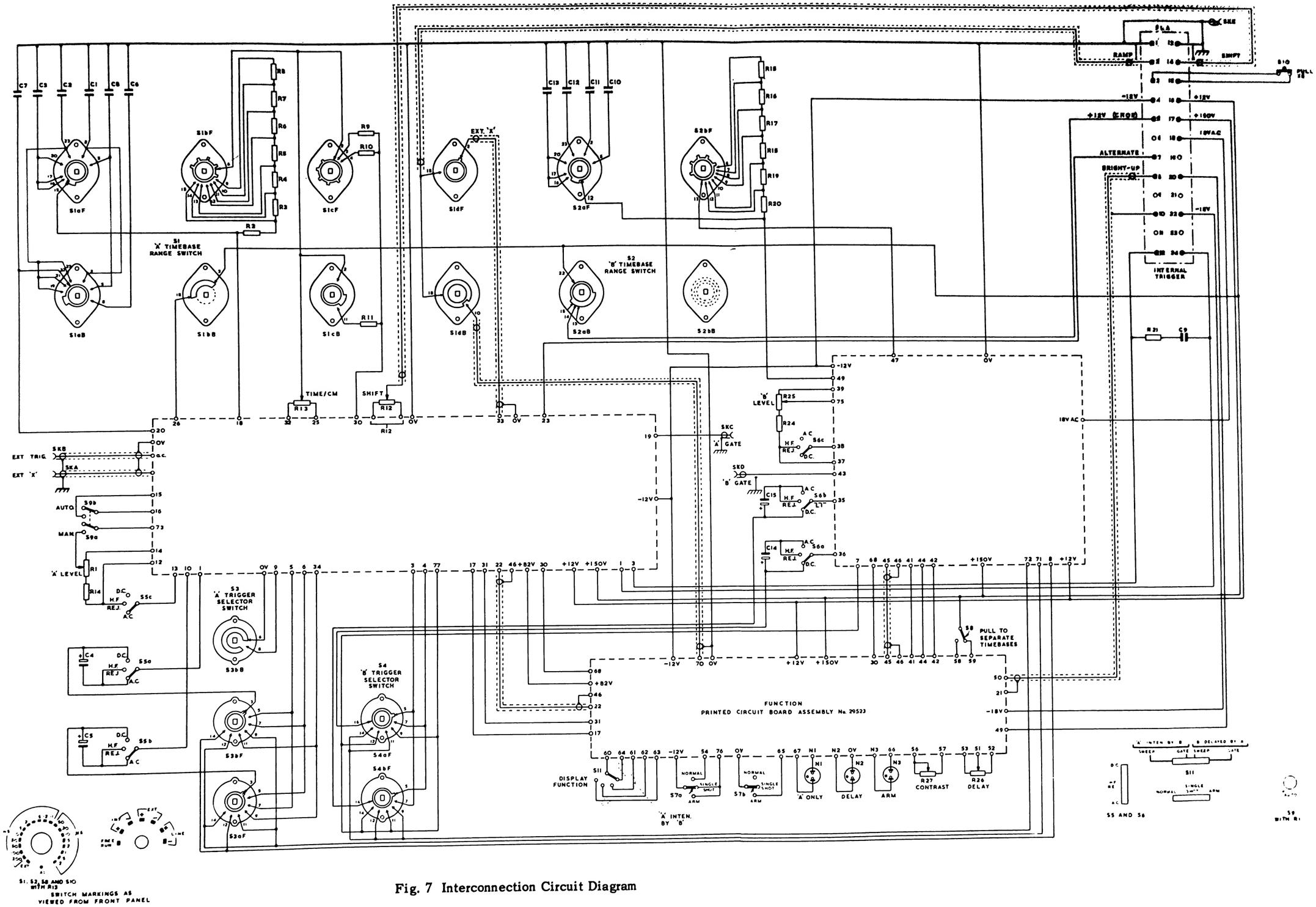


Fig. 7 Interconnection Circuit Diagram

GUARANTEE AND SERVICE FACILITIES

Section 7

This instrument is guaranteed for a period of one year from its delivery to the purchaser, covering the replacement of defective parts other than tubes, semiconductors and fuses. Tubes and semiconductors are subject to the manufacturers' guarantee.

We maintain comprehensive after sales facilities and the instrument can, if necessary, be returned to our factory for servicing. The type and serial number of the instrument should always be quoted, together with full details of any fault and the service required. The Service Department can also provide maintenance and repair information by telephone or letter.

Equipment returned to us for servicing must be adequately packed, preferably in the special box supplied, and shipped with transportation charges prepaid. We can accept no responsibility for instruments arriving damaged. Should the cause of failure during the guarantee period be due to misuse or abuse of the instrument, or if the guarantee has expired, the repair will be put in hand without delay and charged unless other instructions are received.

OUR SALES, SERVICE AND ENGINEERING DEPARTMENTS ARE READY TO ASSIST YOU AT ALL TIMES.

Manual Part No. 30345

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